Ultrasound-guided fine needle aspiration diagnosis of supraglottic laryngeal cancer

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ABSTRACT: Background. Although intraoperative laryngoscopic examination and biopsy of patients who present with locally advanced supraglottic carcinomas remains the standard of care, there are occasions when a more expedited biopsy can be helpful.

Methods and Results. We describe a quick diagnostic technique of ultrasound-guided fine needle aspiration of endolaryngeal advanced supraglottic carcinomas, which can be performed in the clinic without any preparation. Ultrasound scanning is performed through the thyrohyoid membrane. The tumor is visualized as an irregular hypoechoic mass. While continuing to visualize the mass, a 21-gauge needle attached to a syringe is passed through the contralateral thyrohyoid membrane into the mass. Suction is applied, and the aspirate is sent for cytologic study.

Conclusions. When formal intraoperative laryngoscopy and biopsy is not feasible or timely, ultrasound-guided fine-needle aspiration biopsy enables a rapid diagnosis and eliminates the cost, side effects, and risks of a direct laryngoscopy. © 2011 Wiley Periodicals, Inc.† Head Neck 35: E31–E35, 2013

KEY WORDS: ultrasound, FNA, supraglottic, cancer, diagnosis

Over the past several decades, clinicians working in and around the neck have made increasing use of ultrasound-guided biopsy as a diagnostic technique. Initially used for the evaluation and biopsy of the thyroid and parathyroid, the use of ultrasound scanning expanded to the evaluation and biopsy of soft tissue neck masses. We describe a novel use of ultrasound-guided fine-needle aspiration (FNA) to diagnosis 2 patients with supraglottic carcinoma. The ultrasound scanner can be placed over the thyrohyoid membrane to visualize the lesion and guide the needle while it passes through the membrane into the lesion.

CASE REPORTS

Case 1

A 62-year-old white man, with a 40+-year smoking history, presented with a several-month history of hoarseness. There was no cervical adenopathy. Flexible laryngoscopy revealed a prominent mass covered by normal mucosa in the left supraglottic region and a fixed but otherwise normal-appearing left vocal cord. Contrast-enhanced CT of the neck revealed a “soft tissue mass in the supraglottic region on the left. This measures approximately 2.3 cm ML [mediolaterally] and 1.45 cm AP [anteroposteriorly] and [was] 3.2 cm in height. The mass abuts and is indistinguishable from the left vocal cord and abuts the undersurface of the thyroid cartilage. The medial undersurface of the thyroid cartilage is slightly more osteopenic, and the cortex is less well visualized where it abuts the mass, over a length of 5 mm. This is worrisome for invasion in this region” (Figure 1).

Because of the normal-appearing endolaryngeal mucosa, there was some concern that the patient had coccidioidomycosis, which is common in Arizona. To facilitate diagnosis, ultrasonography was performed with a 7.5-MHz linear transducer (Acoustic Imaging Performa, Dornier Medical Systems, Kennesaw, GA, 30144) through the thyrohyoid membrane. A 1.4-cm (mediolateral) × 1.2-cm (anteroposterior) × 0.8-cm (height) hypoechoic, well-defined mass was identified cranial but deep to the upper edge of the thyroid cartilage just to the left of the midline (Figure 2). After informed consent was obtained, ultrasound-guided FNA was performed. The transducer was oriented transversely with a 21-gauge needle and a 20-ml syringe attached to a pistol grip (Figure 3). A drop of the aspirate was placed on each of 3 slides (each smeared out with a clean slide to make 6 slides), and the remainder was flushed in formalin for cell block.

The pathology department received 6 alcohol-fixed smears and a formalin-filled container with small tissue fragments. The latter was used to create a cell block. One of the smears and the cell block demonstrated a cellular material composed of sheets of malignant cells. The malignant cells were arranged in large cohesive sheets with a high nuclear/cytoplasmic ratio, frequent mitosis, and less keratinization. Both the smear and the cell block were diagnostic of poorly differentiated squamous cell carcinoma (Figure 4).

Positron emission tomography/CT was performed that showed focal uptake in the left supraglottic mass, as well as
less intense hypermetabolic activity in the region of left neck level II (without corresponding CT findings) and some activity in hilar lymph nodes. No activity was noted in the lung fields. The patient was then referred for chemoradiation for his supraglottic cancer.

Case 2

A 70-year-old white man, with a 40-pack-year history (who quit smoking in 1987) and a 3-year asbestos exposure history in the 1980s, presented with a 2-month history of hoarseness. There was no cervical adenopathy. Flexible laryngoscopy revealed a paralyzed right vocal cord in the paramedian position with some supraglottic bulging. No ulceration was seen. Contrast-enhanced CT of the neck revealed a right-sided supraglottic–glottic mass measuring 2.0 cm mediolaterally × 1.9 cm (anteroposteriorly) × 1.3 cm (height) microlobulated, mostly well-defined hypoechoic mass was identified protruding from under the thyroid cartilage (Figures 6 and 7A). Informed consent was obtained. Ultrasound-guided FNA was performed with the same technique described above (Figure 7B). In this case dark bloody fluid approximately 1.5 mL was obtained and treated in the same fashion. The pathology department received 6 alcohol-fixed smears and a formalin-filled container with small tissue fragments. A cell block and a thin prep were made from the fragments received in the formalin-filled container. Smears and the cell block demonstrated a cellular material composed of sheets of malignant cells. The malignant cells were arranged in the thyroid cartilage (Figure 5). The CT scan of the lung showed a small lung mass with mediastinal adenopathy.

Initially, the patient refused any invasive procedures. He subsequently agreed to the following office procedure. Ultrasound scanning with the same 7.5-MHz transducer was performed through the thyrohyoid membrane. With the transducer angled somewhat caudally, a 2.6-cm (mediolaterally) × 1.9-cm (anteroposteriorly) × 1.3-cm (height) microlobulated, mostly well-defined hypoechoic mass was identified protruding from under the thyroid cartilage (Figures 6 and 7A). Informed consent was obtained. Ultrasound-guided FNA was performed with the same technique described above (Figure 7B). In this case dark bloody fluid approximately 1.5 mL was obtained and treated in the same fashion. The pathology department received 6 alcohol-fixed smears and a formalin-filled container with small tissue fragments. A cell block and a thin prep were made from the fragments received in the formalin-filled container. Smears and the cell block demonstrated a cellular material composed of sheets of malignant cells. The malignant cells were arranged in
large cohesive sheets with high nuclear-cytoplasmic ratio, frequent mitosis, and less keratinization. Cell block showed nests and cribriform pattern of cells with focal peripheral palisading consistent with squamous cell carcinoma with basoid features (Figure 8). Immunohistochemistry revealed that the neoplastic cells were positive for p63 and CK5/6 and negative for TTF-1 and CK7, confirming the diagnosis of squamous cell carcinoma.

The patient went on to undergo positron emission tomography/CT, which was positive in the larynx and the liver but not in the lung. After further significant procrastination, a biopsy specimen of the right lobe of the liver demonstrated metastatic disease.

**Technique**

The easiest way to access the supraglottic larynx with a needle is via the thyrohyoid membrane. Thus, although the endolaryngeal structures can frequently be visualized even through a calcified thyroid cartilage, it is most prudent to focus the ultrasound scanner through the thyrohyoid membrane. Ultrasound scanning is performed in 2 planes: transverse and longitudinal. The cancer is visualized as an irregular, hypoechoic mass deep to the thyroid cartilage. It is easiest to visualize its exact location by performing longitudinal scanning and using the relationship of the tumor to the thyroid cartilage as a guide. In the transverse direction, it is easiest to start the scan on the thyroid cartilage (which shows up as a strong hyperechoic line with posterior shadowing) and slide the transducer cephalad until the cartilage edge is passed and the tumor becomes easily visible. Measurements of the tumor should be made in both orientations.

The biopsy itself is performed with the transducer oriented transversely over the tumor. Anesthesia is usually unnecessary because only 1 puncture of the needle is
generally used. It is our practice to use a non-safety 21-gauge needle on a 20-mL needle, attached to an FNA pistol for physician comfort and gracefulness. The needle enters the skin from the contralateral side, by use of the contour of the neck to give it immediate depth into the thyrohyoid membrane. By performing microadjustments to the transducer’s position, the needle can be easily visualized and guided into the tumor, at which point suction is placed on the syringe. The needle is repeatedly thrust into the tumor until a drop of blood is seen in the hub of the needle. The suction is released, and the needle is withdrawn. Slides and cell block are prepared in accordance with the preference of the consulting pathologist while an assistant applies some gentle pressure to the puncture site.

**DISCUSSION**

Diagnostic ultrasound visualization of the endolaryngeal structures was initially described by the Japanese in the 1960s.² Rothberg et al.³ used ultrasound scanning through the cricothyroid membrane, as well as through the thyroid cartilage and were able to evaluate thyroid cartilage destruction in advanced laryngeal cancers. They recommended that all T₃ and T₄ lesions undergo ultrasound scanning to evaluate the extent of cartilage invasion. This recommendation came despite use of equipment that would be considered archaic by today’s standards. They believed that they were able to obtain images of the cartilage invasion despite the level of mineralization of the thyroid cartilage. This was confirmed recently by Bozzato et al.,⁴ who found only 16% of
patients in whom the ossification of the thyroid cartilage prevented successful evaluation. Kuribayashi et al investigated the role of ultrasound scanning for the evaluation of T1 and T2 glottic carcinoma with a 7.5-MHZ transducer. Only half of the T1 lesions but almost all of the T2 lesions were visible. They concluded that the “purpose of sonography is to evaluate the depth of the tumor extension, which is a significant negative prognostic factor, rather than detection of the tumor per se.” Toward that goal it was a good predictor of paraglottic spread and cartilage invasion. They also suggested it may be very helpful for evaluation of tumor regression during radiation therapy, which is reported to be an independent predictive factor for local control. It is, however, generally acknowledged today that CT provides far better resolution of extent of spread and cartilage invasion than ultrasound, which can not penetrate cartilage easily, so that routine ultrasound scanning would not be recommended. Despite the various articles that have demonstrated the ability of ultrasound scanning to define the size and extent of a laryngeal cancer, no attempts were made to obtain biopsy specimens of these lesions.

FNA diagnoses of unusual laryngeal lesions have been previously reported. However, all of the reports identified in a PUBMED search of the topic were for unusual laryngeal tumors that presented as neck masses. The histologic conditions were varied, such as chondrosarcomas, a plasmacytoma, and an adenoid cystic carcinoma. All of these tumors had invaded through the laryngeal framework and were palpable.

In our cases, the lesions are not only strictly endolaryngeal, squamous cell carcinomas, but they were also difficult to visualize endoscopically. In 1 case, no real mass was identified with the flexible laryngoscope whereas in the other case the overlying supraglottic mucosa appeared almost normal. There was bulging from the mass under the normal mucosa. Because of the normal overlying mucosa, biopsy with flexible laryngoscopy (or via the older indirect laryngoscopy technique) in the clinic would not have been feasible in either case. Both patients had real reasons for not having operative laryngoscopy: in the first case it was believed that the patient may have had coccidioidomycosis, whereas in the second it was the patient’s persistent recalcitrance. An additional benefit of the procedure, however, is that the patients would have otherwise had to be scheduled for surgery in the operating room under general anesthesia with all the cost and effort that that entails. This would have delayed the diagnosis and might have necessitated the need for preliminary tracheostomy.

The disadvantage of the use of ultrasound-guided FNA to diagnose endolaryngeal carcinomas is that the patient does not have a full evaluation under general anesthesia to aid in staging and documentation for comparison to post treatment response. In 1 of our cases this was unnecessary because he had metastatic disease by the time (several months) he allowed his physicians to complete his workup.

Although fine-needle aspiration biopsy is usually considered a benign procedure, it is possible that the patient might have a significant bleed that could possibly obstruct his airway. Therefore it is important to check coagulation status and obtain informed consent before the procedure. The risk of bleeding is minimized by use of a single needle stick and stopping the biopsy as soon as a drop of blood is noted in the hub of the needle.

In conclusion, ultrasound-guided FNA of endolaryngeal advanced supraglottic carcinomas is feasible as a quick diagnostic technique that can be performed in the clinic without any preparation. In patients or situations where a standard operative endoscopy and biopsy can not be performed, it enables a rapid diagnosis. Because most patients elect to be treated for their laryngeal cancers with chemoradiation, it expedites a diagnosis and obviates the need for general anesthetic. It eliminates the cost, side effects, and risks of a direct laryngoscopy including pain, tooth damage, possible airway compromise, and tracheostomy, as well as anesthetic complications.

REFERENCES